WORLD HERITAGE BIODIVERSITY

Filling Critical Gaps and Promoting Multi-Site Approaches to New Nominations of Tropical Coastal, Marine and Small Island Ecosystems

WEST AFRICA

1.0 INTRODUCTION

1.1 Geographic Extent

The Coastal Zone

The coastline of West Africa from Senegal to Congo stretches between Latitude 16° North and 5° South of the Equator for about 7,000 km. The coastal zone within this biogeographic realm spans a broad range of habitats and biota and includes the islands of the Bijagos Archipelago of Guinea Bissau and the offshore island nations of Cap Verde, Sao Tome and Principe (Fig. 1). This area is dominated by the Gulf of Guinea.

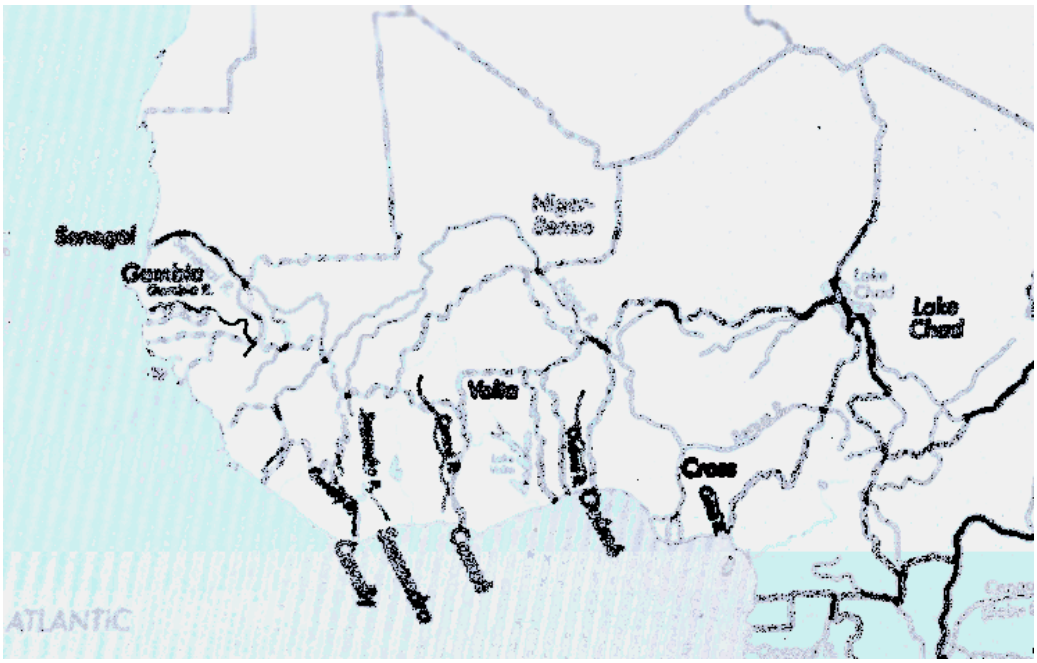

Fig. 1 Major drainage Basins in West Africa

In general the continental shelf of the area is quite narrow ranging between 15 and 105 km (GEF/UNEP, 2001). The widest part of the shelf is off Guinea, Cape Coast in Ghana and the Niger Delta in Nigeria. The shelf generally breaks at depths of between 100 and 120 m (Awosika and Ibe, 1998).

On the west coast of Africa, five distinct and relatively persistent oceanic currents are important. They are the Benguela Current that flows along the coast of the south west African zone veering offshore at about 6°S; the Guinea Current flowing eastward and south-eastward along the coast of the Gulf of Guinea, almost to the Equator, and which essentially constitutes a continuation of the Equatorial Counter-Current; the South Equatorial Current which flows west some distance from the coast between about 10°S and the Equator and the Canary Current which flows south-westward along the coast in the northern part of the region feeding both the Guinea current and the North Equatorial Current. Both the Canary and the Benguela Currents transport cool water towards the Equator and have current speeds of about 20 cm/sec. The Guinea Current carries warm water towards the coast and has speeds of 13 knots with the highest currents in the summer months. All the currents are essentially wind-driven.

The Gulf of Guinea is characterised by a seasonal upwelling between July and August, especially between Cape Palmas and Cotonou (GEF/UNEP, 2001). During this period, the continental shelf and deeper offshore waters exhibit high productivity and support commercial stocks of demersal and pelagic fisheries.

There are two main climatic regions in West Africa. Changes in weather are reflected in the amount of rainfall rather than on temperature. The wet season normally lasts from April to September with a peak in June/July and the dry season lasts from October to March with December and January being the driest months. There is a strong influence of river basin drainage along the west and central coast of Africa. The 6,000 kin stretch of coast from Senegal to the Congo is dissected by fifteen major river systems. Among the most important of these rivers are the Niger, whose

elaborate delta system (joined by the Benue and Imo Rivers) drains a catchment area of over 1 million km^2, the Volta River, with a drainage basin of 390,000 km^2 and the Congo (Zaire) River, which in terms of mean runoff and catchment area, ranks secomd in the world. These rivers contribute over ninety-two million tons of sediment per annum into the Gulf of Guinea (GEF/UNEP, 2001). During the 1970s and 1980s, river inputs decreased in the region coinciding with the period of the sub-Saharan drought (Lamb, 1982) that resulted in reduced flows of almost all the rivers (Mahe, 1998). Also, nearly all the major rivers in the sub-region have been dammed for hydroelectric power generation or irrigation resulting in further reduction in quantities of freshwater and sediment reaching the coastal zone. These hydrologic manipulations have created considerable downstream impacts while accelerating rates of erosion in the coastal zone.

Population and Urbanisation
Along the Atlantic Coast, an estimated 60 million people can be found within a narrow coastal margin some 60 km wide, between Senegal and Nigeria. This narrow belt, which accounts for less than 10% of the land mass of these coastal countries, houses a quarter of their population. Indeed, the Atlantic corridor includes some of the highest centers of population density in Africa. This density reflects the very high intrinsic rate of growth among the countries in the region and the location of so many key cities along the coast such as Dakar, Abidjan, Accra-Tema, Cotonou, Lagos, Port Harcourt, Douala and Libreville. High fertility rates coupled with mounting in-migration from rural areas have resulted in these cities growing at nearly twice the mean annual rate of population growth of 2.9% in the region. Examples are Abidjan 5%, Accra-Tema 6% and Lagos 4.9% (World Bank, 1994).

Urbanization of the coastal zone in West Africa dates back to pre-colonial times, with the flourishing of trade in gold, slaves and other commodities between African kingdoms which controlled the coast and emerging European empires seeking to expand their influence and trade. During the last five hundred years, the economic, political and cultural nodes of many West African states became firmly established along the coast with the development of port facilities and industry to facilitate trade and the simultaneous emergence of these economic centers as administrative hubs and cultural crossroads for the surrounding rural population. With the build-up in modern times of infrastructure and the concentration of economic and social investments in these urban centers, a development magnet has been created that has attracted floods of migrants. Despite the concentration of resources in these urban centers relative to other areas, they have not been able to keep pace with the accelerated rates of population growth experienced in the last two decades. Unemployment is high, up to 50%, housing is overcrowded, water and sanitation is woefully inadequate and social services barely capable of responding to the needs of the society.

Development Activities
Even though the level of industrial development is still low in West Africa, the rate of industrialisation is increasing along the coastal areas. About 60 per cent of the industries in this region are located in coastal cities (UNDP/GEF, 2001). Industries range from textile, leather, food and beverage processing to oil and gas and mineral exploitation. Nigeria is the largest oil producing country in the region.

Agriculture is important to all countries in the region, both at subsistence and commercial level. A number of rural and agricultural practices impact on the marine and coastal environment. The use of chemical fertilisers and pesticides has markedly increased with the development of commercial agriculture and the need to improve food production and protect human health against insect-borne diseases. Salt production is an important industry especially in the area between Cote d' lvoire and Benin. Large quantities of salt are produced around coastal lagoons. In Ghana, for example, large-scale commercial salt winning for export is an important economic activity in coastal wetlands. Tourism is also an important industry in many West African coastal countries including Cote d'Ivoire, the Gambia, Ghana, Guinea, Togo and Guinea-Bissau.

1.2 Unique Ecosystems, Habitats and Species

Wetlands
The west coast of Africa is well endowed with wetlands ranging from tidal swamps and seasonal marshlands associated with river deltas and estuaries to extensive coastal lagoons. A combination of oceanographic, hydrological and geologic conditions has given rise to a system of shallow, interconnecting and productive costal lagoons which extends for about 800 km between Cote d'Ivoire and eastern Nigeria. These lagoons, which cover an open water area of over 400,000 ha,

run parallel to the coast and are separated from the sea by narrow sand dune barriers that are maintained by the easterly transport of alluvial and marine sediments.

Mangroves
A number of mangrove species, particularly *Rhizophora* sp, *Conocarpus* sp, *Avicennia* sp, *Mitragyna inermis*, *Laguncularia* sp, occur almost everywhere along the western African coast. Between Senegal and Angola, extensive mangrove forests and wetlands line the coast covering an area of 25,000 km^2. The areas of highest concentration are

found along the coasts of Guinea and Guinea Bissau, The Gambia, Senegal Sierra Leone ,the Niger Delta and Cross River Estuary. Mangrove forests provide the nutritional inputs to adjacent shallow channel and bay systems that constitute the primary habitat, spawning and breeding grounds for many aquatic species of commercial importance. Mangroves are a particularly important resource for coastal communities being used for firewood, fish smoking, building materials, salt production, oyster culture, fisheries and medicinal purposes, among others.

Fisheries
The coastal aquatic and marine ecosystems of West Africa are very diverse. Landward of these marine areas, the terrestrial biogeography of the coastal zone is even more varied, ranging from submerged coastal forest to desert scrub. Together, these systems harbour a wealth of economically and biologically important resources, from individual species to productive habitats. Commercially and culturally, the natural wealth of the coastal zone has been exploited for centuries, through a combination of traditional rights and formal licensing for use (World Bank, 1994).

The region is rich in living marine resources with the fishing industry providing livelihood for many coastal communities and foreign exchange for the countries. There are fisheries for small pelagic species (round sardinella *(Sardinella aurita,* Clupeidae), flat sardinella *(Sardinella maderensis,* Clupeidae), chub mackerel *(Scomber japonicus,* Scombridae) and anchovy *(Engraulis encrasicolus,* Engraulidae)) and large pelagic species of the family Thunnidae. Exploited coastal demersal species include those of the families Sparidae, Sciaenidae, Lutjanidae and Penaeidae. The fishery resources are exploited by both artisanal and industrial fishing fleets. Over 60% of national fish landings are made by artisanal fishers (UNDP/GEF, 2001). Between 1986 and 1998, the annual catch of both marine and inland species by local fleets in the Gulf of Guinea ranged between 1.l47and 1.462 million metric tons (FAO, 2000). Marine fish catch was between 694,000 and 864,000 metric tons.

Turtles and Marine Mammals
Four of the seven remaining species of marine turtles in the world may be found in the Gulf of Guinea where they lay their eggs at selected places along the shores. These are the Atlantic Green *(Eretmochelys imbricata),* the Leatherback *(Dermochelys coriacea),* the Hawksbill *(Eretmochelys imbricata),* and the Olive Ridley *(Lepidochelys olivacea)* (UNEP/GEF, 2001). Green turtles are classified as endangered and Hawksbill turtles are classified as critically endangered.

Marine mammals that inhabit the waters of the Gulf of Guinea are mainly cetaceans (whales and dolphins) and sirenians (manatees). Of special importance are the Atlantic Humpbacked dolphin *(Sousa teuszii)* and the African manatee *(Trichecus senegalensis).* Both species appear on the IUCN Red List of endangered species; the African manatee is classified as vulnerable and the humpbacked dolphin as highly endangered under CITES. At the end of summer, toothed, fin and humpback whales migrate to the waters of the Gulf of Guinea from Antarctica (Elder and Pernetta, 1991). Three species of crocodile occur in the coastal areas. These are *Crocodylus niloticus*, *C. palustris* and *C. cataphractus.*

Birds
The Gulf of Guinea is embodied in the West African flyway which is the major annual bird migration routes between breeding and wintering areas, including stop over areas in between. Most of the coastal wetlands in the Region provide unique ecological conditions and habitats for migratory birds many of which come from Europe.

Among the marine and seashore birds found in the west coast of Africa are: Common Ringed Plover *(Charadrius hiaticula),* Knot *(Calidris canutus),* Curlew Sandpiper *(Calidris ferruginea),* Bar-tailed God wit *(Limosa lapponica),* Cattle Egret *(Bubulcus ibis)* and the white-winged Tern *(Chlidonias leucopterus).* Also, a number of seabirds breed in the area between Guinea Bissau and Angola. This includes the gull-billed Tern *(Gelochelidon nilotica),* the Royal Tern *(Sterna maxima albididorsalis)* and the Brown Booby *(Sula leucogaster).* It is estimated that the area between Sierra Leone and Ghana holds about 700,000 waders in winter (UNEP/GEF, 2001). A conservative estimate puts the corresponding number between Ghana and Angola at about 300,000 birds.

1.3 Important Threats to Biodiversity

The most important threats to biodiversity in the coastal zone of West Africa are habitat degradation, pollution of coastal waters, coastal erosion, overexploitation of resources and invasion by aquatic weeds (Kouassi and Biney, 1999). The wave of urbanization and development now taking place in the coastal zone is placing increasing pressure on the resources, many of which, because of their open access, are treated as free resources. Growing in-migration and poverty among rural peri-urban households have resulted in exploitative use of open access and common property resources while competing commercial interests in the fisheries and forestry sectors have taken advantage of poorly managed and monitored licensing regimes to mine resources to the point of depletion (World Bank, 1994).

One of the major contaminants of the marine environment as a result of land-based activities is sewage, mainly of domestic but also, in certain areas, of industrial origin. Urban and industrial wastes are, to a great extent, discharged untreated into creeks, estuaries, lagoons and the immediate inshore areas. The risk of contamination extends not only to surface water but also to ground water because of the relatively high water tables in the coastal zone. In the more developed countries of the region such as Nigeria, Co_te d'Ivoire and Cameroon Senegal, hazardous waste disposal, water pollution from untreated industrial effluents and air pollution from gaseous and particulate emissions have resulted in degradation of the coastal marine environment. Solid wastes, including litter and plastics, are also major contaminants. Other contaminants are hydrocarbons and oils from the petrochemical industry, sediments arising from coastal erosion and synthetic organic chemicals.

Coastal erosion is a major problem in almost all the countries of the WACAF region. Rates of erosion exceed 2 m per year in critical areas where villages, roads and other infrastructure are threatened or have been lost. In Lagos and Escravos Harbours in Nigeria, and in Keta, Ghana rates as high as 23-30 m/yr have been recorded (Ibe and Quelennec, 1989). Though the coastline is highly prone to natural erosion and sedimentation processes which include the scouring effects of a high wave energy environment, and strong littoral transport (Allersma and Tilmans, 1993), erosion has been intensified by human activities such as sand wining, construction of coastal structures, damming of rivers and inadequate supply of sediment. For example, in the last two decades, construction of oil refineries and wells, gas and oil pipelines and storage tanks near ports in the oil producing countries of Nigeria, Cameroon and Gabon has interfered with normal coastal accretion processes leading to recession of the shoreline and exposure of these investments to storm damage and flooding.

Threats to fishery resources and marine biodiversity are attributable to habitat degradation linked to upstream deforestation, industrial pollution and construction of dams. Most fisheries are operated without adequate management and control while landing data and knowledge of the fishery stocks is limited. Just as in many parts of the world, overexploitation of fisheries stocks is related to several factors including inappropriate or unenforceable offtake quotas for different species, selective harvesting of "preferred species" and hyper-efficient harvesting methods. Exploitation of fishery resources also impacts on the coastal zone, most directly through the disposal of wastes during fish processing and the demand for fuel wood for fish smoking that has led to extensive felling of trees in and beyond the coastal zone.

The most dangerous floating aquatic weed in West Africa is the water hyacinth (*Eichhornia crassipes*). It was popular as an ornamental plant and spread rapidly through urban rivers and canals and into lagoons. It has vegetative reproduction and long living seeds and is hardly attacked by pests and diseases. It has been a serious problem in particular in the Ebrie lagoon of Abidjan in Cote d'Ivoire, the Aby, Tendo Ehy lagoon complex between Cote d'Ivoire and Ghana and other coastal lagoons of Benin and Nigeria.

2.0 POTENTIAL WORLD HERITAGE AREAS

2.1 Inter-border Clusters

The Estuary of the Great and Little Scarcies – Sierra Leone,
Both rivers have a total catchment area of 20,230 km^2. Towards their mouths at 8^o 54' N and 12^o 43'W, as they empty into the Eastern Atlantic, they merge and widen to form a relatively shallow and narrow coastal plain estuary. The upper reaches of the rivers are major fresh water sources for the local populations. Along the sides of the channels of both rivers and the estuary, mangroves are found up to about 10 km inland. There are no restrictions at the river mouths to the discharge of river flows to the ocean. The annual discharge of the Great Scarcies is about 450 m whilst that of the Little Scarcies amounts to about 300 m. Information on biodiversity of the estuary is limited. Data on the fish species indicate the occurrence of mainly the clupeid family namely *Ethmalosa fimbriata, Sardinella eba, S. aurita* and *Ilisha africana*. These fishes are rather common but the area is known to be important for habouring paleoartic bird species that use the mudflats as feeding grounds. Other bird species include *Arelea goliath, Scopus umbretta, Ciconia episcopus, Haliaetus vocifer* and *Recurvirostra avosetta*.

The cutting of mangroves for fuel wood and tobacco growing activities as well as swamp rice cultivation is the most significant threats. Other threats to wildlife come from hunting, pollution from domestic and commercial activities and fishing. Management practices are based on the need for conservation of fishery resources. The Fisheries Department is the main government agency. Equally important are traditional management practices involving chiefs and elders who are responsible for protecting user rights and fixing fishing seasons, among others. There are also fishing societies that serve as a link between government and local institutions. Apart from the Kuru Hill reserve in the upper reaches of the Great Scarcies, none of the sites are protected (Johnson, pers. comm). The major foreseeable constraint to their nomination as a WH site is the ongoing internal conflict.

Grand Lahou and Ebrie Lagoon Complex – Cote d Ivoire
This large lagoon complex is located between Longitudes 3° 47' W and 5° 29' W and Latitudes 5° 2' N and 5° 42' N. The Grand Lahou area covers about 200 km^2 and comprises the Fresco, Tadio, Niouzoumou, Mackey and Tiaba Lagoons. The Fresco receives water from the Boubo and Gni Rivers while the others are linked to the River Bandama. The Ebrie lagoon, 566 km^2, stretches for nearly 130 km with a maximum width of 7 km. The Azagny National Park (19.000 ha), situated in the littoral area of Grand-Lahou was created in 1981. It harbours a variety of animal including several species of baboons, and the royal antelope, panther, elephant, bush pig, and the chimpanzee. It is a vital bird sanctuary site. Three species of crocodiles, *Crocodilus niloticus, C. cataphractus* and *C. tetrospis* and the alligator, *Aramus niloticus* occur in the area. The Tortoises *Trionix triungius, Pelisios niger Pelisios gabonesis,* and *Cylanorbis senegalensis* are also well spread. These marine species lay eggs on the beaches bordering the lagoons. Many of these are considered as endangered species or are under severe threat form human activities, especially poaching and hunting. For example, the Nile crocodile is considered as 'Vulnerable' on the IUCN Red List of Endangered species and the primates are under increasing threat from poachers who trade their meat on both local and export markets.

About 150 species of fish has been recorded in the Ebrie Lagoon (Angaman, pers. comm..). These are of three main types: species exclusively of estuarine origin such as *Sarotherodon melanoteron Tylochromis jentenki, Tiliapia heudoleutti, Tiliapia guineensis* and *Tilapia mariae*; of fresh water origin including *Chrisicthys nigrodigitatus* and *C. walkeri, Hepsetus odoe*, and *Hemichromis fasciatus*; and of marine origin such as *Elops lacerta, Polydadactylus quadrifilis, Trachinotus falcatus, Liza falcipinnis, Lutjatus dentatus, Sphyraena piscatorum and Ethmalosa fimbriata,*

The major threats to biodiversity are dam construction and civil works, sand winning, domestic and industrial pollution, mangrove exploitation, expansion of aquatic vegetation and inappropriate fishing methods. The construction of dams has also resulted in the closure of openings of lagoons to the sea. Furthermore clandestine fishing using chemicals such as Lindane and dieldrin continue to destroy fish as well as food chains Current management practices are based on governmental initiatives using institutions with mandates to manage the environment. Support is provided by international organisations such as FAO, WWF, GTZ and FFW of the IUCN. There are also numerous non-Governmental Organisations involved intervention issues. Traditional management practices are important especially with respect to fishery resources. No major constraints are foreseen with respect to nomination of the Grand Lahou and Ebrie Lagoon Complex as a cluster WHB site.

Ramsar Sites of Ghana
The 550 km-long coastline of Ghana contains about 90 coastal lagoons and wetlands. In connection with the implementation of the Ghana Environmental Action Plan, the Ghana Environmental Resource Management Project (GERMP) has been initiated with the aim of supporting the adoption of improved management practices through community involvement in the planning and implementation of measures to minimise environmental degradation. The GERMP includes the Coastal Wetlands Management Project (CWMP) the main objective of which is to maintain the ecological integrity of five coastal wetland sites to be maintained as Ramsar Sites. These are the Muni Lagoon, Densu Delta, Sakumo, Songor and Keta Lagoons (Table 1).

The Muni, Latitude 5° 19' N and Longitude 0° 40' W, is a shallow saline coastal lagoon situated about 70 km west of Accra in a generally low-lying undulating plain. It adjoins the Yenku Forest Reserve, which together with the adjacent forest constitutes the traditional hunting grounds of the local people. The main habitat types are the open water floodplain grassland, the degraded forest and scrubland including farmed areas and the sand dune.

The Densu Delta is located about 11 km to the west of Accra, between longitudes 0° 16'and latitudes 5° 30_ N and 5° 32_ N. It comprises sand dunes, open lagoon, saltpans, marshlands and scrublands. Its outlet to the sea is kept artificially open from time to time especially when excess water is released from the Weija reservoir, located 10 km upstream.

The Sakumo Lagoon is located within latitudes 5° 36' N and 5° 38' N and longitudes 1° 30' W and 2° 30' W within the Accra-Tema Metropolitan Area. The lagoon itself is located about 3 km west of Tema and is separated from the sea by a narrow sand dune on which the Accra-Tema coastal road is built. Originally closed to the sea, the Lagoon is kept open by two parallel culverts.

The Keta and Songor Lagoons are associated with the delta at the mouth of the Volta River, near the eastern border of Ghana. The Songor Lagoon is located west of the Volta River, between Latitudes 5 ° 47' N and 5 ° 53' N and Longitudes 0 ° 21' E and 0 ° 35' E, where it is separated from the Atlantic Ocean by a narrow barrier beach. The Keta Lagoon is located east of the Volta River. It is the largest lagoon in Ghana with open water covering about 300 km^2, and with several hundred additional km^2 of surrounding flood plains and marshes (Piersma and Ntiamoa-Baidu, 1995). The Keta Lagoon is separated from the Atlantic Ocean by a coastal ridge ranging in width from 2.5 km at its western edge to only several hundred meters east of Keta.

Table 1 Some Characteristics of Ramsar Sites of Ghana

Name of Site	Major River (s)	Surface Area (km^2)	Bird Population (No. of Species)	Major /Land Use Occupation	Major Threats
Muni Lagoon	Muni	4.5	23,000 (42)	Fishing; Farming;	Waste disposal; Harvesting of fuel-wood; Bush fires
Densu Delta	Densu	22	35,000 (57)	Fishing; Farming; Salt winning; Weija reservoir; Urban development	Waste disposal; Salt production; Uncoordinated development; Unpredictable releases from the Weija reservoir;
Sakumo Lagoon	Mamahuma Dzorwulu	3.5	32,500 (66)	Fishing; Farming Livestock rearing; Housing estate	Waste disposal; Uncoordinated development; Over-fishing;
Songor Lagoon	Volta Sege	115	110,000	Fishing; Farming; Salt winning	Waste disposal; Salt production; Impacts of dams; Overexploitation of mangroves; Over-fishing;
Keta Lagoon	Volta	300	110,00 (72)	Fishing; Farming; Salt winning	Waste disposal; Impacts of dams; Coastal erosion; Overexploitation of mangroves; Over-fishing;

The Ramsar sites (Table 1) as well as other coastal lagoons of Ghana have historically supported artisanal fisheries that comprise a significant proportion of the economic and dietary resources of the human populations clustered around them. Of the five sites, the Keta Lagoon supports the highest number of species. About 20 species each of fin and shell fish have been encountered with consistent predominance of the cichlids, *Sarotherodon melanotheron, Tilapia guineensis and T. zilli*, in order of importance. Edible shellfishes include prawns *Parapenaeopsis atlantice Penaeus notialis,* and *P. duorarum*, crabs *Cardiosoma armatum, Callinectes latimanus* and *Uca tangeri* and molluscs *Tympanotonus fuscatus, Anadara senilis* and *Crassostrea tulipa*.

The Keta wetland is the-most important seashore bird site along the Ghana coast (Ntiamoa-Baidu and Gordon, 1991). All the 72 seashore bird species recorded for the Ghana coast are found here. The bird populations include several thousands of waders, terns, herons and ducks. According to Ntiamaoa-Baidu and Hepburn (1988) the Keta Lagoon alone holds 60% of the total populatictn of waders on the Ghanaian coast. The site supports 8 species of wader populations of international importance. It is also important for the caspian tern as the entire coastal population is often found here. The Songor Lagoon also supports the highest total tern counts along the coast of Ghana. More than 80% of the total number of water fowl are of Paleartic origin.

The Ramsar sites also habour rare and endangered species, the most important of which are the Leatherback Sea Turtle and the Green Turtle which are listed in the IUCN Red List of Threatened Animals (1986) as *"Endangered" and 'Vulnerable'* respectively. In addition, the sites are of great cultural significance and serve as the focus for various festivals that attract large numbers of local and international tourists. Collectively, these five Ramsar Sites are important for maintaining biodiversity in the coastal zone of Ghana.
The major threats to the Ramsar sites include waste disposal from both domestic industrial and agricultural activities, uncoordinated development activities, overexploitation of mangrove and fishery resources and impact of upstream dams (Table 1). For example the construction of two dams on the Volta River has reduced water flow into the Songor and Keta Lagoons leading to development of hyper saline conditions in the latter. Existing management practices are based on the Ramsar concept of wise and compatible use. For each Ramsar site, there is a Site Management Committee with representation from various stakeholders, especially, the local resource users. In addition, all the lagoons are associated with local traditions and customs. Each lagoon has priests and priestess who are responsible for the observance of sacred days during which fishing is not permitted and for closed seasons the opening of which are linked to festivals. The Government of Ghana is a signatory to the Convention of Wetlands of International Importance, Especially as Water Fowl Habitat. There are no foreseen major constraints to the nomination of the Ramsar sites collectively as a WH site.

Ehunli/Akpuho Lagoons and Nyile/Kpani Estuary - Ghana
The area is located along the western coast of Ghana between 4^o 46' and 4^o 48' N and 2^o 05' and 2^o 09' W. It is a few miles north of the major Cape Three Points and between the smaller Capes, Mudrakeni on the west and Buleti on the

east. It comprises two lagoons, the Ehunli and Akpuho and an estuary where the rivers Nyile and Kpani meet. This primarily rural area is in the Ahanta West District of the Western Region of Ghana and includes the villages of Princess Town and Aketekye, which are situated close to the Ehunli and Akpuho Lagoons respectively. This portion of the western coastline, with the nearby Cape Three Points Forest Reserve, is the only area in Ghana where the rain forest lies adjacent to the coast. This unique ecosystem is maintained as a result of the area being the wettest part of Ghana. Rainfall here averages 2000 mm as compared to 200 mm in the drier southeast. A total of 141 species belonging to 58 diverse plant families made up of trees, shrubs, herbs, grasses and sedges have been observed in this area (RC, 2000). The major aquatic plant associations are dominated by extensive mangrove stands (*Rhizophora racemosa* and *Avicennia africana*).

Surveys have recorded a total of 79 species of birds belonging to 26 avian families with paleoartic migrants forming 14 %. No globally threatened species have been recorded for the area, even though 23 species are considered to be of conservation concern. The openness and accessibility of the area offer a great potential for bird watching and tourism. Some of the reptiles that occur in this coastal forest enjoy various degrees of national and international protection. These include the Leatherback Sea Turtle Green Turtle, Nile Crocodile, Dwarf Crocodile Hinged Tortoise, African Python, Graceful Chameleon, and Nile Monitor.

The major environmental issues are coconut disease (Cape St. Paul Wilt), forest degradation, waste disposal and contamination of potable water. In the last twenty years, for example, this coastal zone has been impoverished by the loss of coconut tress (*Cocus nucifera*) upon which the local economy was partly based. In addition, the coastal ecosystem continues to be threatened by pollution, deforestation and loss of biodiversity as well as the inability of local institutions to promote and ensure management of natural resources on a sustainable basis. To reverse this trend, an NGO, Ricerca e Cooperazione (RC), has initiated the Princess Town and Akatekye Coastal Zone and Restoration Project. The Project, which started in 1997, thus has a primary objective of preserving the coastal ecosystem of the area within a sustainable development framework through assessment of biodiversity resources in the coastal habitats; establishment of a monitoring plan to control pollutant and contaminant inputs into the coastal zone; restoration of the Akpuho lagoon; implementation of a village sanitation system; introduction of small-scale agroforestry systems and strengthening of the capacity of Institutions and Departments. No major constraints are therefore foreseen with respect to nomination of the Ehunli/Akpuho Lagoons and Nyile/Kpani Estuary as a cluster WHB site.

Nokoué Lake and Porto Novo Lagoon - Benin
The Nokoué lake is situated at 1^o 56' E and 6^o 25' N and the Porto Novo Lagoon and 2^o 36' E and 6^o 21' N. Together, they form the Ouemé flood plain, the most important water system in Benin. The Nokoue Lagoon has a surface area of 150 km^2 and a length of 20 km in its east-west direction and 11 km^2 in the north-south direction. It opens directly into the Atlantic Ocean by a channel at Cotonou. The Porto Novo Lagoon (30 km^2) communicates with the Nokoué Lake to its west by the 5 km Totché canal and with the Lagos Lagoon on the east through a 100 km canal. On the northern section of these two water bodies is an extensive deltaic plain.

The wetlands of southern Benin are unique with respect to the practise of the fishing method known as 'acadja', which involves the use enclosures made of sticks and tree branches. A total of 46 families representing 106 species of fish are known to occur here. This number encompasses 61% of the total number of fish species found on the African continent. Important species include *Sarotherodon melanotheron* and *Tilapia guineensis*. The wetlands thus serve as important nursery and feeding grounds for several species of fish. They are also the most important sites for water birds in Benin. The bird fauna of the wetlands represent about 55% of the 233 species made up of 52 families that are encountered in Benin. These birds including some palearclic migratory bird species, are attracted to the Nokou and Porto Novo Lagoons as a result of the practice of acadja.

Mangroves present are essentially *Rhizophora racemosa* and *Avicennia germinans.* Around the Nokoue Lake and Porto Novo Lagoon, *Paspalum vaginalum, Typha australis* and *Cyperus papyrus* are found. Coconut trees (*Cocos nucifera*) and oil palm (*Elaeis guineensis*) have also been planted.

The major threats to the wetlands are land degradation as a result of uncontrolled human activities, expansion of the exotic plant species, water hyacinth and deforestation due to acadja fishing. Benin has signed an accord with the Netherlands to ensure sustainable development of the wetlands. This has led to the recognition of the wetlands as areas of international importance to be listed as of RAMSAR sites. Current management practices include a programme to control the water hyacinth, public education campaigns and EIAs of all projects within the wetlands.

Niger Delta - Nigeria
The Niger Delta is one of the world's largest wetlands, encompassing over 20,000 km^2 in south-eastern Nigeria between Latitudes 4^o 8' N and 4^o 37' N and Longitudes 6^o 37' E and 7^o 29' E, approximately. The Niger River has the ninth largest drainage area of the world's rivers. The delta is a vast floodplain built up by the accumulation of sedimentary deposits washed down the Niger and Benue Rivers (World Bank, 1995). It is composed of four ecological zones: coastal barrier islands, mangroves, fresh water swamp forests and lowland rain forests. A dynamic

equilibrium between flooding, erosion and sediment deposition is the defining characteristic of the delta ecosystem. However, construction of dams along the Niger River during the last 25 years has significantly disrupted the hydrological balance.

Nigeria has the third largest mangrove forest in the world and the largest in Africa, over 60% of which is located in the Niger Delta (6000 km^2). Defined by regular saltwater inundation, the mangroves form a vegetative band 15 to 45 km wide parallel to the coast. The Niger Delta has vast petroleum reserves and is responsible for more than 75% of Nigeria's petroleum, by far the country's largest export (World Bank, 1995). The biodiversity significance of the Niger Delta is high from regional and global perspectives. According to the International Union for the Conservation of Nature (IUCN), the Niger Delta is one of the highest conservation priorities on the west coast of Africa. It holds a large number of threatened and endangered species, particularly mammals, that are economically, aesthetically, and scientifically very valuable. For example, the only mammal known to be endemic to Nigeria, Sclater's guenon, is found only in the delta and Cross River ecosystems.

The need for conservation is very high because the area is a center of endemism for Africa and located in the overlap between the upper and lower guinea forest regions. The area has a unique and highly diverse flora and fauna. The Niger Delta and Cross River State region contains 60-80% of all Nigerian plant and animal species (World Bank, 1995). Nigeria has 205 endemic species, most of which are found in the Niger Delta. More than half of the primate species of conservation concern, including numerous species classified as endangered or threatened, inhabit the region. For example, olive colobus *(Procolobus verus)*, red-capped mangabeys *(Cercocebus torquatus)*, chimpanzees *(Pan troglodytes)*, and white-throated or red-bellied guenons *(Cercopithecus erythrogaster)* are found in the delta. Others are Nile monitor lizard *(Varanus niliticus)*, spotted-necked otter *(Lutra maculicollis)*, clawless otter *(Aonyx capensis)*, brush-tailed porcupine *(Atherurus africanus)*, manatee *(Trichechus senegalensis)*, and dwarf crocodile *(Osteolaemus tetraspis)*. The delta is also an important habitat for trans-hemispheric migratory bird species. Even though no systematic bird counts have been conducted anywhere in the Niger Delta (Powell, 1994), over 330 different bird species have been identified. Some vulnerable species that are rare over much of their ranges remain abundant in the delta, such as the Hammerkop *(Scopus umbretta)* and African grey parrots *(Psittacus erithacus)*. The threatened and endemic Anambra waxbill *(Estrilda poliopareja)* occurs in the Niger Delta.

The region has a richer freshwater fish fauna than any coastal system from Gabon to Senegal. Of the 12 new species discovered in Nigeria since 1980, scientists have found 10 of them in the Niger Delta. Two groups of freshwater species are locally endangered. The freshwater catfish (probably *Arius gigas)* has disappeared from much of its range - Volta to Niger systems - and is no longer common in the delta. The coastal species, *Arius parkii* and *A. latiscutatus* may also be declining rapidly. The full significance of the delta's biodiversity remains unknown because new ecological zones and species continue to be uncovered and major groups, such as higher plants and birds, remain unstudied in large areas. This situation calls for increased research.

The major environmental issues of concern in the Niger delta is summarised in Table 2. The two principal threats to biodiversity are habitat destruction and hunting. Both factors are directly tied to road and canal construction increasing the access of farmers, loggers, and hunters to the forests. Population pressure and agricultural land degradation also exacerbate biodiversity losses as they induce people to expand agricultural production and emphasize non-farming activities, particularly hunting. Biodiversity is further lost by the trade in endangered species. Traders commonly buy crocodile, snake, and cat skins. Hunters capture and sell grey parrots, which are classified as vulnerable to extinction for Nigeria, but are locally common.

Table 2 Ranking of Environmental Issues in the Niger Delta

Category	High Priority	Moderate Priority	Low Priority
Land Resource Degradation	Agricultural land degradation; Flooding;	Coastal and riverbank erosion;	Sea level rise
Renewable Resources Degradation	Fisheries depletion; Deforestation; Biodiversity loss Water hyacinth expansion;	Fisheries habitat degradation; Oil pollution;	Mangrove degradation; Nypa palm expansion;
Environmental Pollution	Sewage; Vehicular emissions; Municipal solid wastes; Toxic and hazardous substances.	Industrial effluents; Industrial air emissions; Industrial solid emissions.	Gas flaring.

Source: (World Bank, 1995)

The institutional framework for addressing environmental issues is expanding in the Niger Delta in response to government and stakeholder concerns about environmental degradation. A large number of other federal and state agencies also have environmental responsibilities for mitigating all major environmental problems but severe constraints limit their actual impact. A major problem is that clear divisions of responsibilities often do not exist, leading to inaction or duplication of efforts. In addition, community participation in policy and program development is lacking, thus, community based programmes are few.

There is an Endangered Species Decree that lists 90 rare and threatened fauna for protection, many of which inhabit the Niger Delta. However, vulnerable flora are not similarly listed. The Federal Government has established a national park network covering many natural ecosystems. However the park system fails to include any coastal areas. At the state level, a large number of forest and game reserves have been constituted or proposed in both states but there are problems with enforcement. Some local communities protect aquatic ecosystems in the Niger delta on a variety of levels. For example while some aquatic areas may be protected from all forms of exploitation, partial protection exists for other areas where lakes are only fished every seventh year. The sanctuaries may also be extended to surrounding terrestrial ecosystems. These measures are however not widespread and are only possible where communal tenure systems remain intact.

In addition, the World Bank has proposed that an action plan be developed and implemented to address the priority environmental issues (World Bank, 1995). The major constraint to nomination may be institutional. Reform of local and national institutions are however included in the proposed Integrated coastal zone Management Action Plan. This would aim at, among others, determining which organisations should be responsible implementation.

Nkomi, Ngobe, Ndogo Lagoon Complex – Gabon
These three coastal lagoons are located along the coast between Latitudes 1^o 13' S and 2^o 38' S and Longitudes 9^o 09' E and 10^o 07' S. They are areas of high species richness within a set up of mangrove and adjacent tropical forests. According to the World Bank (1995), they are recognised as protected marine areas.

2.2 Trans-border Clusters

Sine Saloum, Gambia and Casamance Estuaries – Senegal and Gambia
The estuaries of the three rivers make up this cluster located in Senegal and The Gambia. The Saloum estuary is located within 13^o 36' N and 14^o 0' N latitudes and 15^o 16' W and 15^o 30' W. The smaller estuaries of Gambia and Casamance are located at 15^o 26' W, 13^o 27' N and 15^o 16' W , 12^o 29' N respectively. These are humid areas that are particularly important for their mangrove forests, estimated to cover between 3000 to 5000 km^2 (Diop and Ba, 1993). The estuary and mangrove swamp sites of the Saloum are made up of three important groups of islands extending over 800 km2; the Gandoul in the north, the Beteni and Fathala in the south. Though the River Gambia experiences a long-range tidal influence in its lower reaches, mangroves are mainly located on the riverine borders. The mouth of the River Casamance is actually an inverse estuary, with increasing salinities upstream just as for the Saloum. There are three main types of mangrove formations: the rare primary swamp with little or no clearing, the more frequent secondary mangrove, resulting from the exploitation of the primary mangrove and mangrove swamps converted into rice fields, especially common in the Casamance estuary (Diop and Ba, 1993). In the Saloum and Casamance, tall *Rhizophora racemosa* are replaced by groups of *R. harrisonii* and *R. mangle*. There exists in most estuarine areas a recognizable relationship between available shallow-water habitats and the life cycle patterns of commercially valuable fish species. These include demersals *Brachydeuterus auritus, Macroramphosus sp.,* coastal sparids *Pagellus bellotti, Epinephelus aeneus,* and pelagics *Pomatomus saltatrix, Argyrosomus regius, Sardinella aurita, S. maderensis, Decapterus rhonchus,* and *Scomber japonicus.* Also important are shellfishes including *Uca tangeri, Tympanotonus fuscatus, Crassostrea gasar* and *Anadara senilis*. The uniqueness of this estuarine complex lies in the occurrence of undisturbed mangrove areas and in the provision of habitats for migratory wetland bird species, notably, Black-Tailed Godwit, Roseate Tern and Dunun.

The major threats are mangrove harvesting, clearing of swamps for rice cultivation, dam construction and drought conditions over the last three decades. Senegal has two reserves in these areas: the Basse-Casamance reserve and Delta du Saloum, an important palearctic migrant bird site and fish spawning ground. Both government and traditional institutions are involved in management practices, the latter being focuse on conservation of fishery resources. No major constraints are foreseen in the nomination of this cluster as a WH Site.

Aby, Tendo, Ehy Lagoon Complex – Cote d'Ivoire and Ghana
This lagoon complex is located between longitude 2^o 51' and 3^o 21'W and latitude 5^o 05' and 5^o 22' N on the eastern coastline of Cote D'Ivoire and covers an area of 425 km^2. The middle portion, Tendo shares its southern border with neighbouring Ghana. Also, the complex receives continental waters from the Rivers Tano and Bia both of which are shared with Ghana. The Ehotilé National Parks of about 500 hectares in area, are a collection of six islands dispersed within the Aby lagoon just before its confluence with the sea. These islands are: Assoco-Monobaha, Niamouan, Belouate, Mea, Elouame. Et Bosson-Assoum. They were set up as Parks in 1974 at the initiative of the local populations. About 60 species of fish have been recorded in the Aby, Tendo, Ehy Lagoon complex. The other characteristics are the same as for the Grand Lahou and Ebrie Lagoons.

Cross River Estuary – Nigeria and Cameroon
The Cross River is formed from numerous headwaters rising from the western slopes of the Cameroon highlands, which have two parts in Nigeria; the Obanda hills in the south and the Obudu hills in the north. As the main river

enters Nigeria from Cameroon, it follows in a westward direction and turns southwards and enters the Atlantic Ocean as the Cross River Estuary. Its main tributaries are Anyim-Aya, Abonyi, Asa-Aboine, Enyong Creek and Calabar River. The total area of the Cross River basin is about 54,000 km^2 of which 40,000km^2 is in Nigeria. The Cross River Estuary has served as a loading point for slaves during the slave trade era but is now an import and export point for goods and for extraction and transportation of logs. The estuary forms one edge of the strand coast of Nigeria, which stretches for 85 km from the Imo River. One of its most important features is its extensive mangrove region made up of *Rhizophora racemosa*, *R.harrisonii, R. mangle, Avicennia africana* and *Laguncularia racemosa* Interspersed with the mangrove are other plant species like the nypa palm (*Nypa fruticans*) and raphia palm (*Raphia hookeri).* The estuary is also an important fishing area. A thriving industry centred on the estuarine shrimp *Nematopalaemon hastatus* occurs in the estuary. Being close to the Niger Delta, it shares similar unique floral faunal species, some of which are not only endemic but also endangered.

Major threats to biodiversity arise from the impacts of oil exploration, oil spills, deforestation coastal erosion and pollution. With respect to conservation efforts, the Okumu and Cross River national Parks have been established as special wildlife conservation areas within mangrove swamp forests. Some NGOs also have instituted programmes on various aspects of environmental protection. Activities include promotion of public awareness and interest in the conservation and protection of biological diversity in the coastal zone, and provision of expertise and guidance on matters affecting the coastal environment. In addition to NGOs there also community-based organizations that are involved in self help projects.

3.0 EXISTING WORLD HERITAGE SITES

Of the various categories of tropical marine, coastal and small island ecosystems cited by Green (2001), eleven are located in West Africa as follows: Gambia-1; Senegal-2; Guinea-1; Cote d'Ivoire-1, Ghana-3, Guinea Bissau-1, Democratic Republic of Congo-1 and Congo-1. None of these is on the World Heritage list.

Site Nominated but not Inscribed

Faunal Reserve of Conkouati, Congo
This faunal reserve with its endangered species of marine turtles will suffer less degradation when it is inscribed as a World Heritage Biodiversity Site.

Madeleine Islands National Park, Senegal
This site is located just north of the transborder cluster consisting of the estuaries of Rivers Saloum and Casamance in Senegal and Gambia in Gambia. Its characteristic of being an important site for numerous colonies of seabirbs also makes it compatible with the other sites of the cluster.

Site Recognised under UNESCO Man and Biosphere Programme

Delta du Saloum, Senegal
This site in Senegal has a high potential for expansion as a transborder cluster site incorporating the estuaries of the River Gambia in Gambia and the River Casamance in Senegal. It has been described in Section 2.2 above.

Boloma Bijagos, Guinea Bissau
This area has a high potential to be inscribed a s an intra-border cluster.
Sites Recognised under the Ramsar Convention on Wetlands

Baobolon Wetland Reserve, Gambia
There is not much information on this site but judging from the information available (Green 2001), it forms part of the cluster proposed for Senegal.
Ile Blanch - Guinea
This is a site with an unusual occurrence of coral on the west coast of Africa. Information available on it is scanty and it is therefore difficult to assess its potential for expansion. In view of its peculiarity, it may be more beneficial to exclude it from a cluster. Common management practices in a cluster may lead to its unusual characteristic being overlooked.
Park National d'Azangy, Cote d'Ivoire
This park has been described above as part of the Grand Lahou and Ebrie Lagoon Complex in Cote d'Ivoire. It thus has a high potential to be included in an interborder cluster.
Muni Lagoon, Densu Delta and Sakumo Lagoon, Ghana
Five sites, including the Densu Delta, Muni and Sakumo Lagoons are recognised under the Ramsar Convention in Ghana. These three lagoons have thus been described in Section 2.1 above with two others, the Songor and Keta Lagoons. The potential for expansion of this cluster depends on future designation of other coastal lagoons as

proposed Ramsar sites. This potential is high since lagoons of similar size and ecological stress occur along the coast of Ghana.

Parc National des Mangroves, Democratic Republic of Congo

This site has a good potential according to its description by Green (2001).

APPENDIX 1

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